

In the specification:

Please substitute the following paragraphs for the paragraphs at the indicated locations in the specification as originally filed or most recently amended.

Page 2, line 22+:

For an optical system ~~riying~~ relying on a clamping system to secure optics in place and in alignment, large clamping forces may be required to meet the 6G specification where the clamping force must at least equal the mass of the optic multiplied by six times the acceleration of gravity. Due to various factors such as available space, materials costs and the like, space for holding the optics may be very small. Large clamping forces applied over small areas for holding or mounting the optic also generate high levels of stress. Unfortunately, some materials from which some parts of an assembly may be made may be subject to degradation of important properties when subjected to stresses for substantial periods of time.

Page 8, line 3+:

Referring now to the drawings, and more particularly to Figure 1, there is shown in side view, a schematic depiction of a generalized form of the invention for mounting an object 10 such as a lens, mirror, reticle, mask or the like relative to (e.g. against) a surface 20 with a clamp which, for simplicity, is shown, in one form, as a lever 30 pivotally supported at pivot 40 affixed to surface 20 or, in an alternative form, as a cantilevered arm 30'. Clamp 100a and/or 100b do not have to be initially in contact with object 10. In a preferred embodiment, either clamp 100a or 100b makes

contact and, in conjunction with vacuum passage 320 (Figure 3) supplies the required ~~clamping~~ clamping force for static operation. Alternatively, vacuum passage 320 can supply the required static clamping force (e.g. slightly above the force required to maintain alignment at rest) and clamp 100a and/or 100b may provide an additional force deemed appropriate within a safety factor specification. This additional force might assist in any time lag effects due to the control system as will be discussed below. None of the mechanical details of the clamp 30, ~~40~~ 30, mounting surface 20 or object 10 are of any importance to the basic principles of the invention. However, it is preferred that the tip or contact point of clamp 30 is a vacuum compatible/non-outgassing type of rubber or polymer, a non-corrosive metal or even a ruby tip such as that used on the stylus of a surface finish measurement device. It is also preferred for most applications that a plurality of clamp arrangements (e.g. 30, 50, 60, or, collectively, 100) be positioned around the periphery of object 10 as illustrated, for example, in Figures 1 or ~~2B~~ 2A - 2C.

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The output of the acceleration reporting device 70 is processed, as symbolically indicated at element 80, and supplied to the active actuator(s) to increase the clamping force to correspond to any acceleration for the duration of the acceleration. This processing may be as simple as amplification or even direct application of the accelerometer output but may be as complex as may be required by the physical properties (e.g. mechanical resonance) of the assembly or other structure ~~to~~ with which the assembly may be combined. An additional input 85 may be provided for mixing, adjustment or control of

gain, synchronization with other portions of a device in which the assembly is used and the like. It is preferred that the additional clamping force be dynamically variable, continuously or step-wise, with acceleration in a generally analog manner (but not necessarily linearly proportional to acceleration), commensurate with acceleration and limited to a level only slightly in excess of that needed to retain the object 10 in position on mounting surface 20 under a given acceleration or otherwise resist the acceleration detected in both degree, direction and kind (e.g. vibration, impact, etc.).

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In general, the frictional engagement between surfaces which are stationary with respect to each other is somewhat greater than the frictional engagement between surfaces sliding over each other. This difference in frictional engagement and/or a slight excess of static clamping force is generally adequate to prevent shifting of the clamped object during processing and application of the accelerometer signal to the dynamic clamping structure, including ~~it's~~ the response time of the control arrangement. Any inadequacy in this regard can be remedied by increasing the static clamping force which will thus remain well below that required to carry the full acceleration load which may be potentially encountered. Therefore, positioning flanges or pins which may have other undesirable effects in regard to optical elements, in particular, can be avoided while preventing relative shift between an object and ~~it~~ its supporting structure. Different types of clamps can be selectively deployed (e.g. by mechanical, electrical or pneumatic arrangements as will be discussed in greater

detail below) and/or actuated individually or in combination, possibly by a plurality of signal processing arrangements 80 as may be determined to be needed and desirable under various conditions that are detected by one or more acceleration reporting devices.

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Specifically, vacuum diversion passages 410 are provided which are in communication with vacuum passages 320. A sensor assembly with valves 420, the details of which are unimportant to the practice of the invention, is provided to detect the presence of object 10 and to open valve 430 to divert vacuum to retract carriage frame 440, preferably having a movable seal, for example, riding (as indicated by arrow 460') in vented cylinder 450 against a compression spring 460 to retract the clamp from the edge of the location of object 10. This retraction is reliably repeatable, easily synchronized among a plurality of clamp jaws and avoids the need for complex motion to remove the object 10 from among the clamp jaws or more complex mechanical movements of the jaws which may be difficult to synchronize for multiple jaws. When another object is placed in that location, valve 430 is closed and the clamps return to an operative location above the edge of object 10.

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As shown in Figure 6, a reticle handler/loader 600 is positioned over the vacuum table 300 and carries a reticle 610 by, for example, a vacuum pick-up arrangement. The reticle handler/loader may also carry inductor coils to wirelessly charge or energize the active actuator such as the piezoelectric device(s) illustrated. However, as will be discussed below, such

inductors and/or actuators 630 could be provided on a separately positionable structure, as may be desirable in some applications. The reticle handler/loader also preferably carries a mechanical actuator 630 which may be, for example, a linear motor, piezoelectric transducer (PZT) or simply a pin or post set at the proper height to actuate the lever 522 when the reticle loader/handler is lowered to place the reticle 610 on the vacuum hold down table 300 as shown in Figure 7. At the time the reticle 610 is placed on the vacuum table, a vacuum is applied to vacuum hold down passages 510 and, in the first mode of operation, no pressure is applied through air passage 515.

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This actuation of the lever 522 of latch 520 releases the piston 530 carrying clamp 500 which is then moved toward the reticle by compressed spring 532 positioning the clamp over the reticle edge. Alternatively or additionally, a separate (e.g. pneumatic) arrangement could be employed to release latch 522, as shown in Figure 5A. At this point, the active actuators 60 of clamps 500 are actuated, preferably by charging through inductors 620 and the clamps 500 brought into contact with the reticle. The reticle handler/loader may be allowed to remain in place during use or the reticle released and the reticle handler/loader moved to another position with or without movement of the inductors 620. However, it is contemplated that the charging of the active actuators 60 of clamps 500 will cause force to be applied during movement of the reticle handler/loader to prevent any vibration or acceleration at the reticle from such movement from causing a shift of the reticle during such

movement. Thus, even with the inductors 620 being moved away with the reticle handler/loader, no shifting of the reticle will occur and energization of the active actuators 60 can be performed thereafter in the normal manner (e.g. responsive to an ~~acceleraometer~~ accelerometer of the reticle stage control signals through, for example, wired connections.

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The ~~embodiment~~ embodiment illustrated in Figure 10 employs an actuator with Belleville washers as a preload, although depending on actuator design, the spring preload may not be necessary. The construction of the mechanical advantage actuator, as shown in this embodiment, with a PZT stack 60 and a flexured yoke structure 1010 which can be purchased commercially, is less sensitive to shear forces and is configured in a manner which may be geometrically advantageous in some applications. ~~A~~ a similar actuator may employ a pneumatic bellows in place of the PZT stack.

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In the embodiment illustrated in Figure 11,, the addition of the flexure (in which the axial direction is constrained to transmit force in that direction and all other degrees of freedom are unconstrained, or universal joint reduces the risk that side loads or shear forces may damage the PZT stack used as an actuator. The spring in series with the flexure or universal joint and actuator provides preload in order for the actuator (e.g. PZT or bellows) to apply variable (increased or decreased) force. The mechanism is designed so that the clamp ~~released~~ releases object 10 at the "full travel" point of actuator movement.

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Referring again to Figure 5, another ~~emodiment~~ embodiment of the present invention which is intended to use the additional vacuum ports shown in Figure 13 (similar to those shown in Figure 3A) is illustrated in Figures 14 - 17. This variation on the additional vacuum actuator embodiment of Figure 3A incorporates a mechanism on the stage with additional surface area ~~with additional surface area~~ where extra vacuum is applied to generate additional clamping force. Figure 13 shows an exemplary arrangement of vacuum ports for holding a reticle, mask or the like object 10 in place on the stage. Such vacuum chucks are used on various stages in lithography tools. Also shown are the extra vacuum port arrays 320' intended to be used with the clamp assist mechanism shown in Figures 14 - 17. One or more of the added ports may be used to provide the required clamping force during acceleration. These extra vacuum ports may also supply a small amount of vacuum during normal operation (e.g. at rest).